

**TWP Nauru(ARCS-2) Site  
Installation Report**  
28 September – 24 November 1998  
Denig Site, Republic of Nauru

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**1.0 INTRODUCTION:**

The goal of the TWP ARCS-2 Installation was to leave Nauru with a functioning ARM Climate Station with a full suite of instruments capable of delivering a continuous stream of credible data to the ARM community. We wanted to install this site in complete cooperation with the Nauru government.

**2.0 TWP INSTALLATION MANAGEMENT:**

The installation of ARCS-2 in Nauru was broken into the following areas of responsibility:

- Overall Installation Director: Larry Jones
- Installation Site Directors(phased): Larry Jones, Mark Ivey
- Installation Site Administrators(phased): Monty Apple, Clif Meyer, Rose Marra
- Nauru IDI liaison and local education outreach: Fairley Barnes
- ARCS-2 Packing and Shipping: Monty Apple
- Instrument Calibration: Bill Porch
- Data quality: Jim Mather
- Site Prep coordination: Fairley Barnes, Mark Ivey, and Warner Ecklund

Site rules and definite work hours were established. New installation team arrivals were given a Nauru and site orientation and safety briefing. Daily tasking meetings were held at the site. Progress was tracked to the planning schedule developed before installation. Daily progress reports were written and distributed to TWP management in the states. AIS technical personnel were assigned responsibility for the successful installation of specific instruments.

*TWP AIS System Leaders:*

- Fred Helsel
- Larry Yellowhorse
- Jeff Zirzow

- Peggy Malone
- Doug Scott

*Other Technical, Scientific Personnel:*

- Chuck Long
- Ken Weaver
- Guy Wilcox
- Dick Eagan
- Jeff Schmaltz
- Ken Moran
- Tom Ayers
- Conner Flynn
- Colin Maxfield
- Artie Kovacs
- Joe Bartsch

*Nauru IDI and NPC Personnel, Local Observers, Security and Other Help:*

- Carmen Willis, Nauru IDI
- Megan Aliklik, Nauru IDI
- Henry Harris, Nauru IDI
- Nicolas Durbbbbbb, Nauru IDI
- Andrew Pitcher, Nauru IDI
- Joseph Cain, Nauru IDI
- Bernadette Aliklik, Nauru IDI
- Lockley Denuga, Local contractor
- Franklin Teimitsi, Nauru IDI
- Ernest Diema, Nauru IDI
- Squire Jerimiah, Nauru IDI
- Roda Baguga, Local contractor
- Tim Ainginea, NPC
- Jack Mullard, NPC
- Peter Marstin, NPC

**3.0 INSTALLATION PREPARATION:**

Preparation for this Installation involved two years of gathering instruments, purchasing equipment, testing the instruments, and integrating the instruments into a data collection and dissemination network, instrument testing. Calibration was performed at the Albuquerque Integration Site at Sandia National Laboratory. It was then completely inventoried, packed into transportainers and shipped by sea to Nauru. Concurrently a level, fenced-in site was prepared in Nauru with the necessary infrastructure of water, power, phone, and diesel fuel.

#### **4.0 INSTALLATION ACTIVITY:**

The following entries are taken unchanged from daily installation reports.  
The text may contain minor grammatical errors and abbreviations.

##### **A. Preliminary Setup Work:**

###### **09/28:**

- Transporter inspection at the site – some damage noted.

###### **09/29:**

- Site inspection: fence completed, local hardware store stocks look good.
- Set up internet accounts.

###### **09/30:**

- Forklifted the Vans to their final positions.
- Porta potties installed.
- Discussed major water shortage on island due to drought. Drinking water is obtained at island desalination plant. Fire truck filled U-Van water tank.
- Hired site construction laborers.

###### **10/02:**

- SMET tower concrete foundation poured.
- Other instruments being poured.
- Confirmed bank deposit completed.
- Opening ceremonies planning started.

###### **10/05:**

- Met with Nauru IDI government officials on Installation Plan.
- Rented additional vehicle.

###### **10/06:**

- Got TWP site vehicle from customs.

###### **10/07:**

- TWP bank account set up at Nauru National Bank.

###### **10/14:**

- Paid up for one year on Internet account with Cenpac.

###### **10/16:**

- Opening ceremonies planning continues.

###### **11/17:**

- Opening ceremonies planning continues.

- Set up site work order, procurement system.

### ***B. Education Outreach:***

**09/30:**

- Meetings with Baron Waga on Education Workshop for November.

**10/06:**

- Waga tours ARCS-2 site.

**10/08:**

- Reef preservation meeting with Cain.

**11/09:**

- Science Curriculum Implementation Workshop for Nauru Teachers begins.

**11/12:**

- Science Curriculum Implementation Workshop for Nauru Teachers continues.
- Teachers tour the ARCS-2 site.

**11/13:**

- Science Curriculum Implementation Workshop for Nauru Teachers completed.

**11/16:**

- Meeting with Nauru Secondary School Science and Social Sciences staff.

**11/17:**

- Led Nauru Teacher tour of ARCS-2 site and the NTF Tidal Site.
- Met with Nauru Education Department and Education Secretary.

### ***C. Infrastructure:***

**10/06:**

- Backhoe begins utility trenching around Vans.
- Transformer meter changed from 60A to 130A.

**10/07:**

- Backhoe utility trenching complete.

**10/08:**

- Installed conduit and wiring from Transformer to U-Van.

**10/09:**

- Installed conduit and junction boxes for Van power.
- Power turned on to U-Van and 2 AC units hooked up by extension chord.
- Cut through concrete slab for H2 Van conduit trench.
- Desalinator arrived on site.

**10/10:**

- Continued to install conduit and junction boxes for Van power. Rented 2 cell phones.

**10/12:**

- Hired additional local electrical help from NPC.
- Power hooked up to D-Van, E-Van and I-Van.
- Installed single phase transformer on U-Van stand.
- Mounted I-Van fiber junction box. Ran conduit to H-Van and SMET tower.
- Set UPS powerbox.
- Met with NPC to arrange construction of Van canopy and permanent outhouse.

**10/13:**

- Power conduits run to field instruments.
- Grounding counterpoise laid with CAD-welded connections to grounding rods.
- Replacement electrical meter ordered from Australia.

**10/14:**

- Power and fiber conduits run to field instruments ongoing.
- Nauru government having problems getting new site phone line on Island.
- I-Van power distribution box hooked up.

**10/15:**

- Purchased Van canopy materials.
- Mounted X-Van AC Unit. Completed grounding system.

**10/16:**

- Canopy construction started. AC, DC Power and fiber conduit runs to field instruments completed.
- AC wiring pulled.
- Trenches being backfilled.

**10/19:**

- Installed 240/110 transformer, GFICs in 110 breaker box and pulled wired to Skyrad stand.

- Water tank hauled to site.

**10/20:**

- Ran DC power to Skyrad, grnrad stands.

**10/22:**

- Ran AC power to H-Van.
- Attempted to dig seawater well on the site, but abandoned attempt due to soil caving.

**10/23:**

- Site powered up all night.
- Received approval to get waterline from hospital.

**10/24:**

- Australian phone cable order hung up.
- Found possible phone cable on island.
- Pulled fiber optic cables to Vans.

**10/26:**

- Began terminating fiber optics.

**10/27:**

- Fiber optics terminations completed.

**10/28:**

- Nauru telcom brought phone cable to site.

**10/29:**

- Nauru telcom began trenching for phone cable to site.

**10/31:**

- NPC began water connection line from Nauru General Hospital.

**11/03:**

- Phone line trenching continues.

**11/05:**

- Pitcher to get work restarted on Banyon tree.

**11/09:**

- Phone line finally reaches site.
- Banyon tree trimming resumes.

**11/10:**

- Phones at site work.
- Shut down site power to install 3-phase monitor.
- Island shipping process being worked out.

**11/11:**

- Site sign construction started.
- New restroom roof installed.
- Arranged for transportainer outside fence to be rented for storage use.

**11/12:**

- Finished painting exposed conduit.
- Backhoe leveled out site.
- Transferred surplus wood to Nauru General Hospital.
- Wired outside lights to have separate switches.

**11/12:**

- Nov All site power systems begin hands off testing run.

**11/13:**

- Site fiber as-built work.
- Connected U-Van and fuel tank to grounding system.

**11/16:**

- Site cleanup started.

**11/17:**

- Desalinators transferred to Nauru General Hospital to help ensure ARCS-2 water supply from Hospital.
- Site sign completed.

***D. System/Instrument Installation:*****General:****11/11:**

- All instruments reporting.

**11/13:**

- Nauru IDI personnel tour the site.

**11/14:**

- Transferred as built site drawings to zip discs for trip home.

**11/16:**

- Prepared site software backups for return to states.
- Site data being reviewed and validated.
- Met on site surface and decided to leave it as is for now.
- Site tour for Nauru government officials.

**11/17:**

- Began packing for home.

**11/19:**

- Dinner to honor observers with ARM and Nauru dignitaries.

**11/20:**

- ARCS-2 Opening Ceremonies!!!
- Observer training certificates awarded.
- Site tours conducted.

**11/23:**

- Completed Audit-Out.

**Vans:**

**10/05:**

- Fixed U-Van water pump.

**10/06:**

- Mounted AC units to U, D and I Vans

**10/07:**

- Mounted remaining AC units. Wired all AC units.
- Y-Van and E-Van cleaned out, shelves mounted.
- Breaker boxes mounted on U-Van.

**10/08:**

- Unpacked and installed shelves in X-Van.

**10/09:**

- Repositioned H-Van with giant forklift.

**10/10:**

- Set up E-Van with printer, tables, and file cabinets.

**10/13:**

- D-Van cleaned out. Mounted AC unit on AERI.



**10/17:**

- AC unit mounted to Y-Van.
- Wired AC unit on X-Van.
- Lights installed inside Z-Van.
- All conduit trenches filled except at H2 Van.
- Canopy framing construction continues.
- Unloaded I-Van and MMCR equipment.

**10/19:**

- Wired AC unit on the Y-Van.

**10/20:**

- Wired and powered up AC distribution panel outside the U-Van.
- Local Air Conditioning man worked on storage van AC units.
- Canopy construction completed.

**11/21:**

- Installed dehumidifiers in Vans.

**10/23:**

- Vans began running hands off.

**10/30:**

- Completed AC Unit enclosure construction.

**11/02:**

- D-Van AC Unit repaired.
- Van as-built drawings started.

**11/03:**

- Van phones being installed.

**11/10:**

- Z-Van AC Unit failed.

**11/11:**

- Site water supply operational.
- Phones, fax and data lines hooked up in Vans.
- Z-Van AC unit repaired.
- Arranged for transportainer outside fence to be rented for storage use.

**11/12:**

- Started labeling shelves on storage vans.

**11/13:**

- As-builts of van interiors completed.

**11/16:**

- Rental van cleaned out and reorganized.

**11/18:**

- Sorted out D-Van cabling.

**11/19:**

- Organized Z-Van.

**11/21**

- Inventoried Y-Van and Z-Van.

**GENSET(Emergency Generator):**

**10/19:**

- Hooked up diesel line to U-Van Generator.

**10/21:**

- Received diesel fuel. Started Genset.

**10/23:**

- Genset water jacket heater keeping engine too hot.

**10/30:**

- Tested Genset transfer switches.

**Loggers:**

**10/27:**

- Grnrad and SMET loggers are communicating to AdaM.

**10/28:**

- Started putting calibration values into data loggers.

**11/03:**

- Started calibrating data loggers.

**11/12:**

- Resealing data loggers containers.

**11/14:**

- Loggers began running hands off.

**SKYRAD, GRNRAD Instruments:**

**10/07:**

- First Skyrad stand set up.

**10/08:**

- Second Skyrad stand set up.

**10/12:**

- Anchored Skyrad stands.
- Aligned stands N-S.

**10/13:**

- Set up Grnrad stand.

**10/21:**

- Installed Brusag solar tracker on Skyrad Stand.

**10/22:**

- Brusag powered up and running.
- Began installing Epply radiometers.

**10/23:**

- NIP mounted on Brusag.

**10/30:**

- Oriented MFRSR on skyrad stand.

**11/13:**

- Cavity Radiometer session completed.

**11/14:**

- Instruments began running hands off.

**11/16:**

- Cavity Radiometer session completed.
- Returned Grnrad radiometers back to pointing downward.

**11/17:**

- Removed Cal Logger and comparison radiometers from Skyrad stand.
- Installed stairway for Skyrad stand.

**11/18:**

- Radiometer data files sent to Cornwall in States.

**SMET:**

**10/09:**

- Oct Set SMET tower base with giant forklift.

**10/13:**

- SMET tower installed. Aligned stand N-S.

**10/16:**

- ORG stand mounted to concrete base.

**10/23:**

- Oriented and leveled the ORG.

**10/26:**

- Installing SMET instruments on tower.

**11/10:**

- SMET logger, instrument calibration started.
- Rea- time met data acquisition possibilities being investigated.

**11/14:**

- Prepared code to produce hourly SMET data and wind shears for observer use.
- SMET instruments began running hands off.

**11/18:**

- SMET data files sent to Cornwall in States.

**MWR:**

**10/16:**

- MWR mounted and aligned on stand.

**10/26:**

- MWR computer powered up ok.

**11/02:**

- MWR orientation questioned.
- Tip mode alternately sites over ocean and then land.

**11/14:**

- Instrument began running hands off.

**11/19:**

- Installed new MWR software to allow ADaM to ingest tip mode data.

**11/23:**

- MWR heater still on since yesterday.
- Sensor appears to have been affected by salt buildup.

**Ceilometer:**

**10/14:**

- Mounted Ceilometer on concrete pad.

**10/23:**

- Oriented and leveled the Ceilometer.

**10/26:**

- Ceilometer computer powered up ok. Ceilometer rotated to allow N-S orientation when lowered for calibration.

**11/12:**

- Instrument began running hands off.

**11/21:**

- Fixed Ceilometer so that it could communicate properly with the Ceilometer computer.

**MPL:**

**11/02:**

- Started unpacking MPL.
- Laser looks to be undamaged.

**11/12:**

- MPL data being analyzed.

**11/14:**

- MPL overlap calibration completed.

**11/16:**

- Temperature control module repaired.
- Instrument began running hands off.

**11/19:**

- MPL began reporting red on GOES H&S summary.

**11/21:**

- Performed MPL overlap correction test – results good.

**AERI:**

**11/02:**

- Started unpacking AERI Van.

**11/04:**

- AERI setup progressing.

**11/05:**

- Noise problem discovered on thermocouple channels.

**11/06:**

- MMCR eliminated as noise source.
- Sterling cooler not sounding good.

**11/13:**

- Replaced AERI thermostat and worked on AERI blower.

**11/14:**

- Replaced AERI blower with spare. Instrument began running hands off, but AERI Mads is yet to be installed.

**11/16:**

- AERI Mads installation begins.

**11/17:**

- AERI Mads installed and configured.
- Hands off run begins.

**11/18:**

- Cleaned AERI mirror.
- Backed up the AERI data on the MADS and cleaned up the AERI Van.

**11/23:**

- Switched the Ambient and Hot Black Body controllers and this reduced the noise that was being seen.

**MMCR:**

**10/20:**

- Installed MMCR antenna atop I-Van.

- MMCR instrument and computer installed.

**10/22:**

- MMCR running and taking data.
- Antenna cover restraint tabs pulled loose.

**10/26:**

- Started hands off testing of MMCR system.

**11/13:**

- MMCR data sent to USA for analysis.

**11/14:**

- Instrument began running hands off.

**11/17:**

- MMCR failed.

**11/18:**

- Checked MMCR for loose wires – none.
- Replacement TWT to be “rushed” to Nauru.

**11/19:**

- MMCR TWT removed for shipment back to States for repair.

**11/20:**

- MMCR replacement arrives at Brisbane.

**11/23:**

- MMCR TWT power supply arrived at Nauru. Power supply installed and works fine.

**WSI:**

**10/12:**

- Set up WSI stand.

**10/14:**

- Stand leveled.

**10/27:**

- WSI cable pulled thru conduit to I-Van.

**10/28:**

- White box set up at instrument on stand.

**10/30:**

- Silicone sealant adhesion problem on instrument in the field.

**11/06:**

- Powered up WSI.

**11/10:**

- Night session at site to investigate light pollution for WSI.
- Additional circuit installed for WSI.

**11/11:**

- Occultor calibration work done.

**11/12:**

- Installed fabric on NE fence to screen hospital lights from WSI.

**11/13:**

- Sealed up data and power line conduits at the instrument. WSI data sent to USA.
- Installed more fabric on NE fence to screen hospital lights from WSI.

**11/14:**

- WSI starts hands off run.

**11/16:**

- WSI alarm message problem.
- May revert to old software.

**11/17:**

- Reverted to old WSI software.

**Cimel:**

**10/14:**

- Concrete pad and trench set for future Cimel installation.

**SDL:**

**11/14:**

- SDL installed in E-Van.

**ADaM:**

**10/23:**

- Powered up ADaM.



**10/26:**

- MMCR data being ingested.

**10/27:**

- Grnrad and SMET loggers are communicating to ADaM.

**10/28:**

- MWR reporting to ADaM.

**11/03:**

- General ADaM work with PNNL.

**11/17:**

- Synced up ADaM/EVE and backed up the ADaM/EVE software.

**11/18:**

- Performed ADaM to EVE failover tests.

**11/21:**

- Failed EVE over to ADaM.

**Network:**

**11/04:**

- Installed fiber and routers.

**11/14:**

- Installed APC master switches for MWR, Ceilometer and MPL.

**11/21:**

- Rewired bit driver in conjunction with Ceilometer.
- Worked on quadrapump configuration – lines too noisy.

**ACCESS:**

**10/27:**

- Pulled wiring for SAM and powered it up.

**10/30:**

- Found bugs in SAM system that occurred during Genset transfer switching.

**11/02:**

- Troubleshooting problems on SAM and RACE.
- Developed interconnect diagrams, documentation.

**11/03:**

- Calibrating SAM sensors.
- Started hands off testing of SAM.

**11/04:**

- Started hands off testing of Inmarsat B.

**11/16:**

- Meetings with Cenpac for possible internet data communication.

**11/21:**

- E-Van power monitor problems.

**GOES:**

**10/26:**

- Started GOES installation.

**10/27:**

- Connected GOES antenna and powered it up.

**10/29:**

- GOES transmissions being received at PNNL in US.

**10/31:**

- Continue to work on GOES.

**11/03:**

- Started hands off testing of GOES.

**BBSS:**

**10/19:**

- Installed BBSS antenna atop the E-Van.

**10/30:**

- Received three bottles of Helium from NOAA topside site.

**11/02:**

- Digicora installed. Conduit for BBSS antenna run.

**11/03:**

- BBSS antenna cables installed.

**11/06:**

- Launched first balloon (Helium filled).
- Tested Digicora.
- Later in the day launched H2 filled balloon.

**11/09:**

- Launched three test balloons.

**11/10:**

- Observers launched test balloon.
- Balloon launching procedure documented.

**11/11:**

- Observers launched test balloon.

**11/13:**

- Observers launched test balloons(Helium).

**11/14:**

- Water vapor comparisons between MWR and radiosondes not good.

**11/16:**

- Water vapor comparisons between MWR and radiosondes performed.
- Balloons launched with Helium.

**11/17:**

- Observers launched test balloon with Helium for calibration checks.

**11/18:**

- Sonde data concerns communicated to Lesht in States.

**11/19:**

- Observers launched 4 balloons.

**11/20:**

- Observers launched balloons. Ordered new helium bottle regulator.

**11/21:**

- Sonde RH readings suspect. Looking at solutions.

**H2 Generator:**

**10/28:**

- Started filling cells on H2 Generator.

**10/30:**

- Found bad H2 Generator electronics module and replaced it with spare.

**11/03:**

- Started work on water supply for H2 Generator.

**11/09:**

- Emergency shower installation complete.

**11/11:**

- H2 Generator develops regulator problems.
- Needs Australian BOM repair.
- Installed H2 Generator shutoff switch.

**11/20:**

- H2 Generator regulator repaired, but breaker problems persist.

**11/23:**

- H2 Generator stop working.

**Remote Balloon Launcher(RBL):**

**10/13:**

- H2 Generator equipment and Balloon Launcher arrives at Nauru.

**10/26:**

- BOM personnel unpacked RBL.

**10/27:**

- Conduit run to RBL.

**10/29:**

- Concrete pad poured for Launcher and Release mechanism.

**10/30:**

- Assembled RBL on pad.

**11/02:**

- Worked on release area cage footings.

**11/03:**

- Started work on water supply for RBL.

**11/06:**

- Balloon launch cable found to be too short.
- Temporary jury rig installation completed.

**11/09:**

- As-builts for H2 Generator, launcher set up being drawn.

**11/11:**

- Water pump repaired.

**11/12:**

- Replacement release cable installed and tested.

***E. Observers/Security Guards:***

**10/08:**

- Began Observer interviews.
- Observer starts photographing site Installation progress.

**10/09:**

- Hired additional Observer and two security guards.

**10/12:**

- Interviewed security guard applicants for final position.

**10/13:**

- Started Observer training.
- Security guard equipment box installed.

**10/14:**

- Completed observer training Module #1.
- Security guards begin patrolling site perimeter.

**10/15:**

- Completed observer training Module #2.
- Interviewed and selected final observer.

**10/16:**

- New observer training on Module #1.

**10/17:**

- New observer training on Module #2.

**10/21:**

- Trained observers on electrical system.

**10/24:**

- Trained observers on MMCR, session #1.

**10/27:**

- Trained observers on MMCR, session #2.

**10/28:**

- Trained observers on MMCR, session #3.

**10/30:**

- Trained observers on Skyrad instruments.

**10/31:**

- Trained observers on Skyrad, Grnrad and SMET instruments.

**11/02:**

- Trained observers on Daily, Weekly, Monthly rounds.

**11/03:**

- Trained observers on H2 Generator, session #1, and general troubleshooting.

**11/04:**

- Trained observers on H2 Generator, session #2, Daily rounds, WSI, ADaM and Inmarsat B.

**11/04:**

- Trained observers on H2 Generator, session #3.

**11/09:**

- Trained observers on balloon launching.

**11/10:**

- Trained observers on balloon launching.

**11/11:**

- Trained observers on balloon launching, and on field instruments and what they measure.

**11/13:**

- Trained observers on MPL, AERI and Ceilometer.

**11/14:**

- Observers performing rounds.
- Trained observers on DC power system and Genset rounds questions.

**11/16:**

- Trained observers on SDL, BBSS computer, ADaM, SAM, RACE, Inmarsat B, and GOES.

**11/17:**

- Trained observers on AERI Mads, “media management”, and ADaM.
- Established site rules, observer rules, observer shifts, security shifts.

**11/18:**

- Trained observers on general office duties, US communication, shipping, tape mailings, etc.
- Also trained the observers on the WSI and how to reboot ADaM.

**11/19:**

- Trained observers on cleaning the AERI mirror.
- Observers did daily rounds on their own. Lead Observer(OIC) resigns, new one hired.

**11/20:**

- Observer training certificates awarded.
- Observer shifts revised for three observers instead of four.
- Observers did daily rounds.
- Trained observers in mixing chemicals for the Oxygen tester.
- Trained Observers on the WSI and the “Observer Computer.

**11/21:**

- Trained observers on using e-mail and the **www**.
- Trained observers on accessing wind data for sonde initialization.
- Observers used procedures to replace the NET dome.

**11/23:**

- Nov Trained observers on changing dessicant in the Epply radiometers.

**5.0 ATTACHMENTS:**

- Attachment 1—Installation Tasking Plan Schedule
- Attachment 2—Installation Personnel Schedule

- Attachment 3—Daily Reports
- Attachment 4—Site Plan
- Attachment 5—Site Photos
- Attachment 6—Audit-Out Form



## **Attachment 1—Installation Tasking Plan Schedule**

## **Attachment 2— Installation Personnel Schedule**

## **Attachment 3— Daily Reports**

## **Attachment 4— Site Plan**

## **Attachment 5— Site Photos**

## **Attachment 6— Audit-Out Form**